

Southern Hemisphere Additional Ozonesondes (SHADOZ) Comparisons to OMI-Derived Products (2005-2009): Progress & Instrument Issues

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BACKGROUND & GOALS

The SHADOZ project has operated in the tropics and subtropics since 1998 (Thompson et al., 2003; 2011, 2012). During the Aura period, July 2004 - present, four stations joined SHADOZ so that 15 stations operated during 2005-2009, **Figure 1**.



Figure 1.

Data from the 15 2005-2009 stations are used to:

- 1) Create profile climatologies at each station; three tropical regions are defined: Eastern Indian Ocean/West Pacific; Equatorial Americas; Atlantic/Africa.
- 2) Compare total ozone column amounts among sondes, ground-based instruments (6 sites) and OMI overpass total ozone.
- 3) Compare tropospheric ozone column from sondes with GSFC TTOR archived product.
- 4) Examine column and profile comparisons among stations to detect potential biases.

1. MEAN PROFILES - THREE REGIONS

In **Figure 2**, median profiles of ozone, temperature, water vapor mixing ratio, with 25-75% limits are shown. Watukosek for eastern Indian Ocean, Costa Rica for Equatorial Americas, Ascension for Atlantic/Africa.

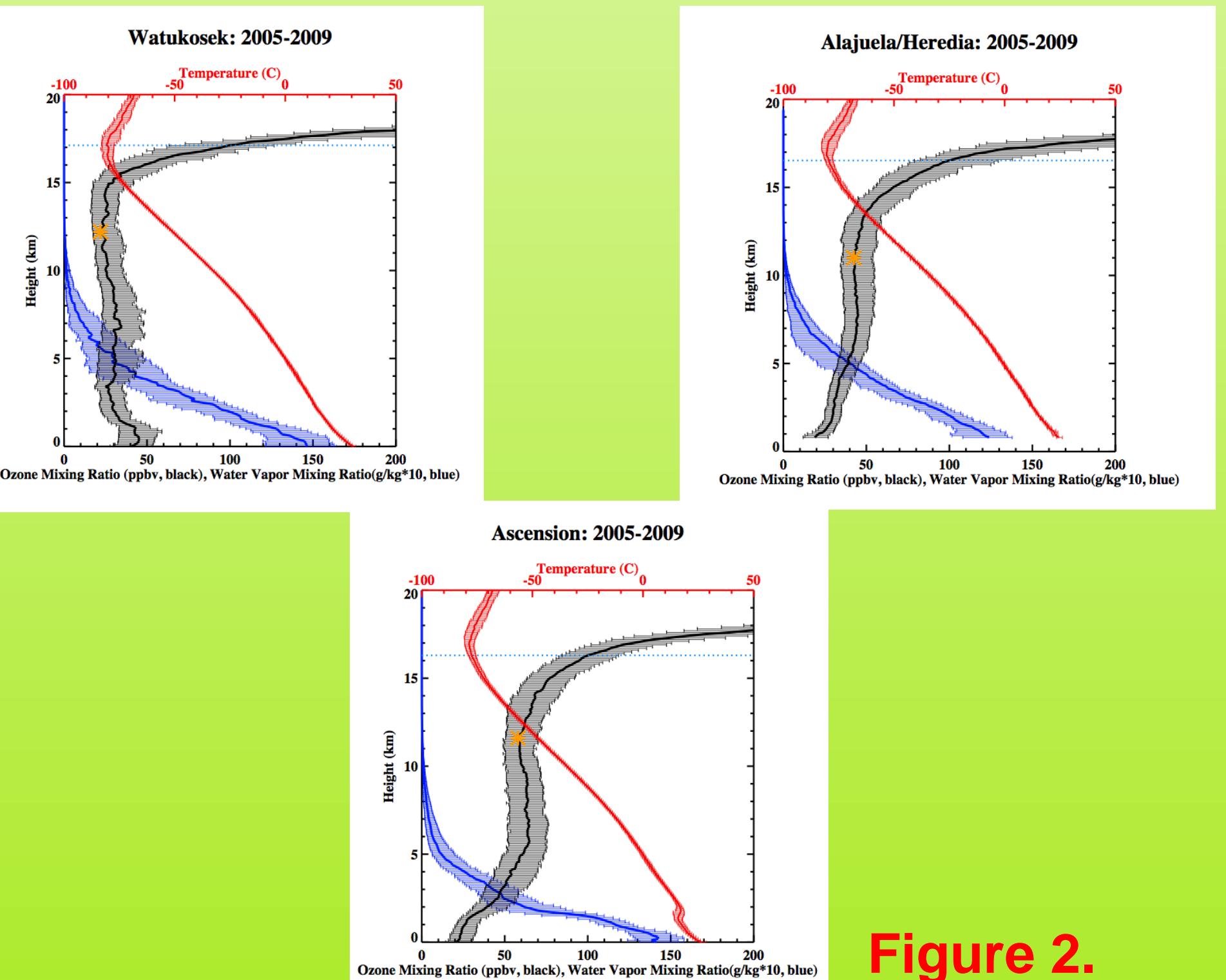


Figure 2.

2. TOTAL OZONE COMPARISONS

In **Figure 3**, satellite total ozone is based on OMI v8.3. Surface ozone instruments are Dobson (Samoa, Nairobi) & Brewer (Paramaribo). Summary of OMI-sonde total ozone agreement (**Figure 4**, below), is generally better than during the Earth-Probe period (Thompson et al., 2007). Some of the improvement is due to the new above-burst climatology (McPeters and Labow, 2012). Samoa modified the sonde sensing solution in 2005; this also improved OMI-sonde agreement.

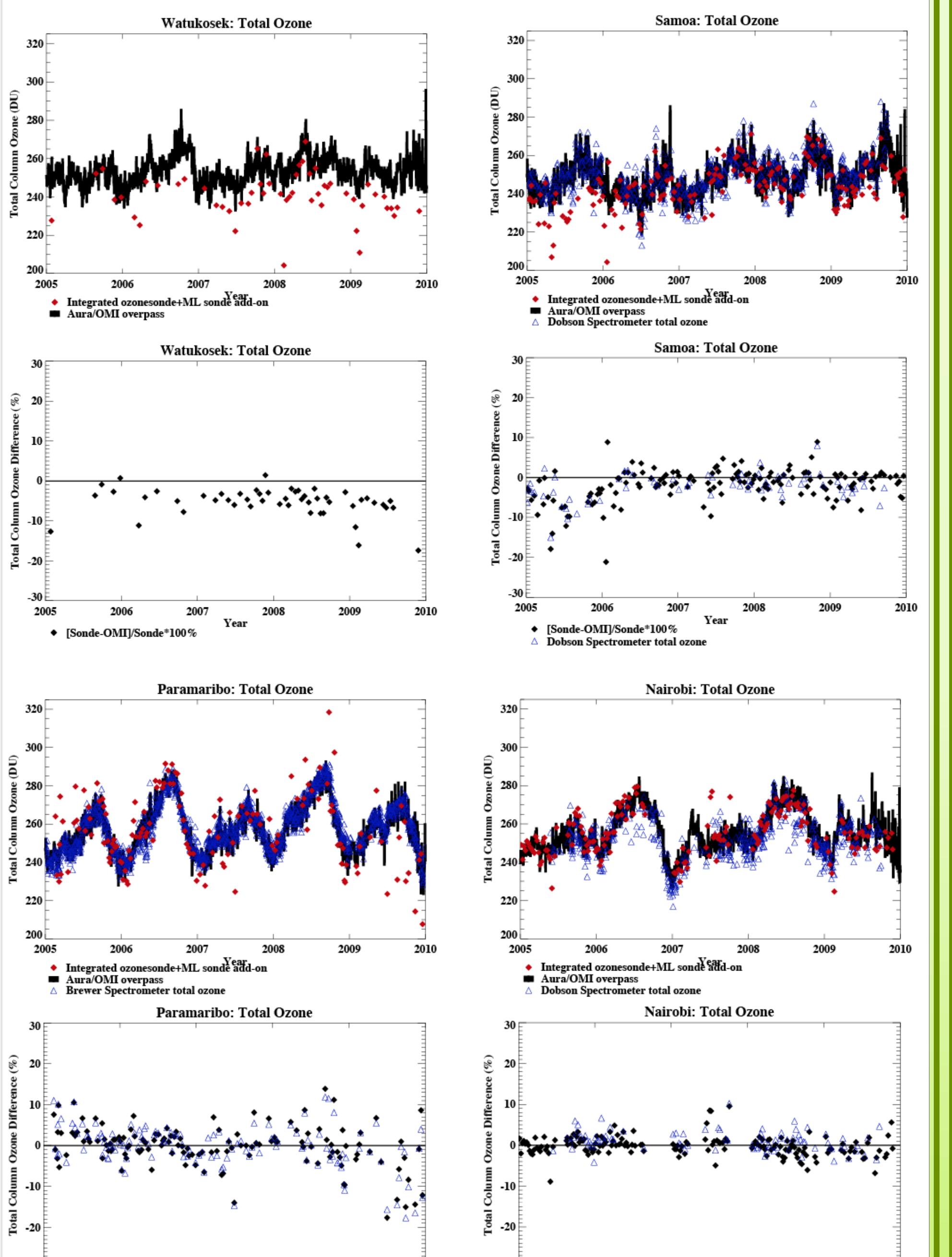


Figure 3.

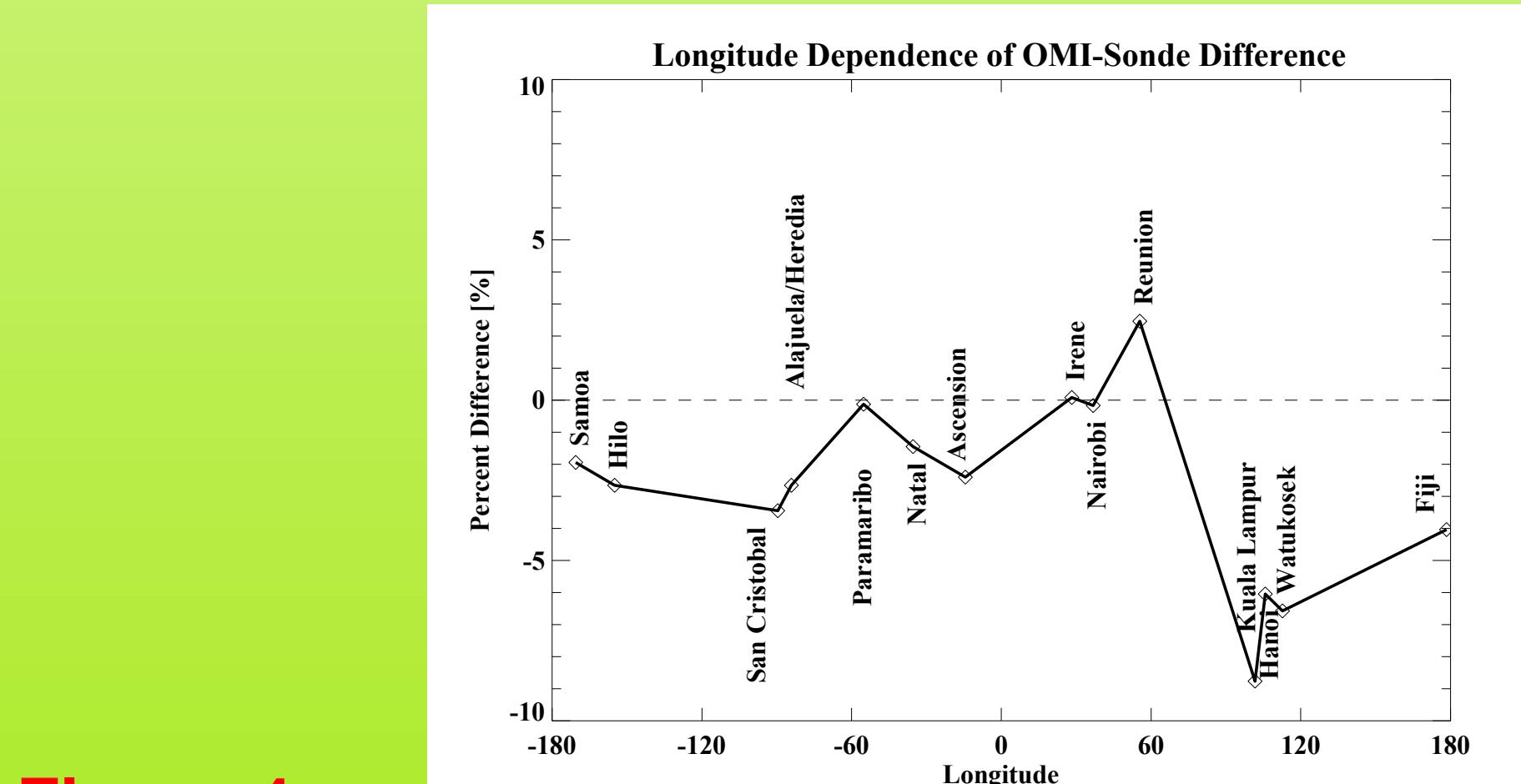


Figure 4.

3. TROPOSPHERIC OZONE COLUMN COMPARISONS WITH GSFC TTOR

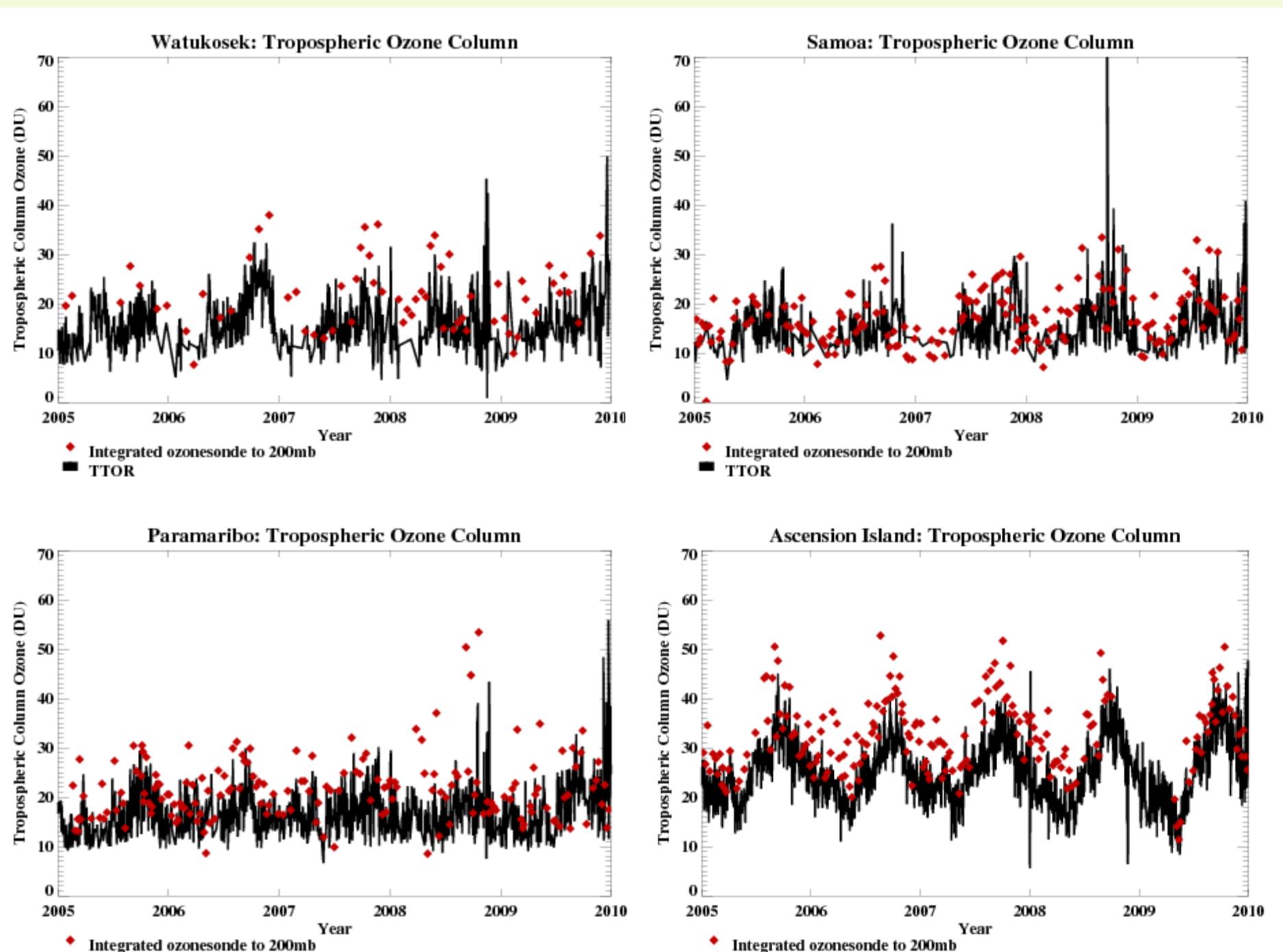


Figure 5.

Tropospheric ozone, the TTOR (Trajectory-enhanced Tropospheric Ozone Residual; Schoeberl et al., 2007) product, consisting of trajectory-mapped MLS differenced with OMI, was obtained from <ftp://hyperion.gsfc.nasa.gov/pub/aura/tropo3>. The comparisons in **Figure 5** show that in general the TTOR is lower than sonde-integrated tropospheric column ozone. The overall seasonality is present, but the maxima are not reproduced very well.

4. LOWER STRATOSPHERE

Column ozone amounts are used to compare stations, as shown in **Figure 6**. The upper frame shows the 100-10 hPa column, which, within 1-sigma, is fairly uniform. Some of the more subtropical sites, e.g., Hilo and Reunion, are the highest. In the lower region, TTL (15-20 km), Hilo, Irene and Reunion are higher than the more tropical stations.

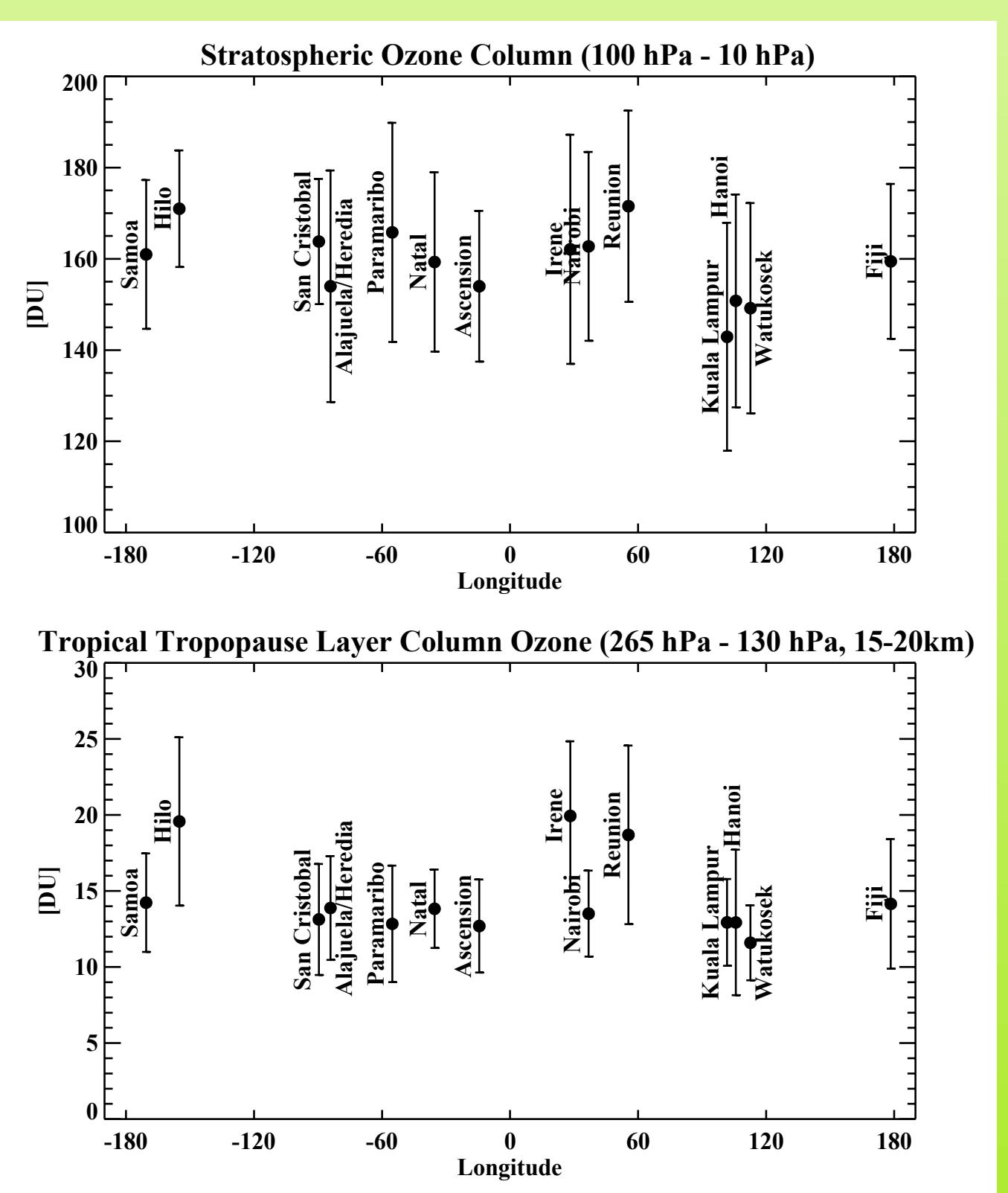


Figure 6.

5. SONDE BIASES

In studies with 1998-2004 SHADOZ data, we explored possible sonde biases in the stratospheric segment of the profile by referencing the mean profiles between 10 and 100 hPa to an all tropical SHADOZ profile (Thompson et al., 2007). Extending this record, the OMI-era sondes show similar patterns. Nairobi is offset on the high side (see **Figure 7** below).

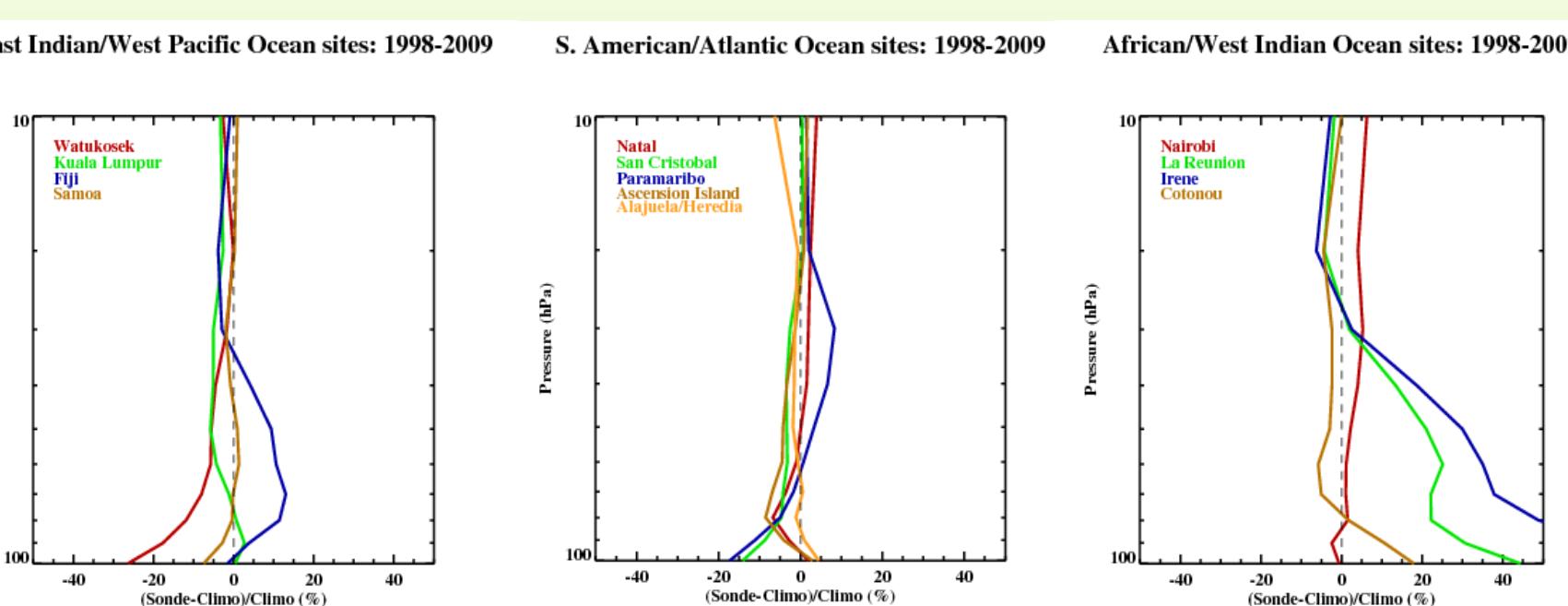


Figure 7.

During 14 years of operations, ECC (electrochemical concentration cell) instruments from 3 manufacturers have been deployed with a variety of sensing solution types, pump correction factors, and radiosondes (**Table 1**, below). SHADOZ stations are presently reprocessing their data to compensate for these variations, according to recommendations of the O3S-DQA (Ozonesonde-Data Quality Assurance) activity of WMO-IGACO/Intl Ozone Commission/SPARC to create a unified dataset for the user community.

SHADOZ Instrumentation, 1998 - 2012

Station	Instrument	Solution	Redundancy
Costa Rica (Various locations)	2Z	1%, 1/10 buffer	RS-80 (up to 2008/09), After 2010/09/19 a mix of RS-80 & Imet
Ascension Is, UK	mix of 2 and 6A	1%, full buffer	Sippican Mk2
	Z (1998-1999/023, 2000/083-2002/0529, 2007/083-2008/057, 2009/01-2009/28-present)		
	6A (1999/030-2005/123, 2008/018-2009/113, 22 (2006/105-2006/1018)	0.5%, half buffer	RS-80 (1998-2006), ModelMK2 (2007-)
Reunion Is, France	6A	1%, full buffer	RS-80, MK2DC - French Modern
Kuala Lumpur, Malaysia	6A	1%, full buffer	RS-80, Sep 2004 - Jan 2009
Ha Noi, Vietnam	1Z (Sep 2004-May 2009), Since May 2009 use 2Z for monthly launches and 4Z for winter months	2% unbuffered (2004-2007), 1% buffered (2008-present)	RS-80, until Jan 2009
Natal, Brazil	6A (1998-2000/511, 2002/0619-present), Z (2000/202-2002/0612)	1%, full buffer	Spacetrack MK2
Paramaribo, Surinam	6A	1%, full buffer	RS-80 until 2009/17
Java, Watukosek, Indonesia	Marie (1998-1999/0721), 2Z until present	2%, unbuffered	RS-80 with Ensci
Hilo, USA	A mix of 2Z and 6A's, but mostly 2Zs		RS-80
Pago Pago, American Samoa	6A (1998-2006/0410), Mostly 2Z until the present	2% unbuffered (1998/02-1998/09), 1% unbuffered (1998/0415-2005/1018), 1% 1/10 buffer (2005/1019-2006/1023), 1% unbuffered (2005/1129-2009/0701), 1% 1/10 buffer (2009/1201-2010/0308), 0.5%, half buffer (2010/0309-2010/0310)	RS-80
Suva, Fiji	6A until 2005/1124, 2Z - present	1% full buffer (1997/02-1998/0427), 2% unbuffered (1998/030-2005/1124), 1% 1/10 buffer (2005/1125-2010/0310), 1% 1/10 buffer (2010/0329-present)	RS-80
Nairobi, Kenya	2Z until 2010/0609, Z - present	1% full buffer until 2010/03, 0.5% half buffer until present	RS-80 until 2010/03, RS-82 - present
San Cristobal, Ecuador	Mostly 6A's until 2006/0120, 2Z until end of record 2008	2% unbuffered until end of record 2008	RS-80 until end of record 2008, restarted 2012/05 with 1% 1/10 buffer, restarted 2012/05 using RS92
Irene, SA	6A	1%, full buffer	RS-80
Cotonou, Benin	6A	1%, full buffer	RS-80
Malindi, Kenya	6A	1%, full buffer	RS-80

Table 1.

ACKNOWLEDGMENTS & REFERENCES

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